REMARKS

Claims 20-34 and 45-51 are all the claims pending in the application. Previously claims 1-19 and 35-44 were canceled without prejudice or disclaimer. New claims 47-51 have been added to further define the claimed subject matter. Reconsideration and allowance of all the claims are respectfully requested in view of the following remarks.

Claim Rejections - 35 U.S.C. § 103

- The Examiner rejected claims 20-22 under §103(a) as being unpatentable over US Patent 5,264,831 to Pfeiffer (hereinafter Pfeiffer) in view of Japanese 58-201027 to Murata (hereinafter Murata). Applicants respectfully traverse this rejection because: (i) there is no proper motivation to combine the references as suggested by the Examiner; and (ii) the references fail to teach or suggest all of the elements as set forth and arranged in the claims.

(i) First, there is no proper motivation to combine the references as suggested by the Examiner because the references teach away from their combination. And it is improper to combine references where the references teach away from their combination.[1]

The Examiner notes that Pfeiffer fails to disclose a detection device including an actually vibrating part facing a cavity.[2] The Examiner then relies on Murata as teaching this feature, and asserts that one of ordinary skill in the art would have been motivated to provide such a cavity to Pfeiffer so that Pfeiffer's vibrating part is "in direct exposure to the material and this would give an accurate level detection."[3]

However, Pfeiffer specifically teaches that there should be **no** cavity in the container wall. See: col. 1, lines 52-59 ("does not require any opening in the container wall") ; col. 1, lines 21-41 (discussing problems with openings [cavities] in the container wall); and col. 3, lines 21-24, 38-40.

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[1] *In re Grasselli*, 713 F.2d 731, 218 USPQ 769, 779 (Fed. Cir. 1983).

[2] Office Action at page 2, item 2, 2nd paragraph, lines 8-9.

[3] Office Action at page 3, lines 6-8.

Therefore, one of ordinary skill in the art would have been taught away from the Examiner's suggested modification of Pfeiffer, and would not have provided Pfeiffer with a cavity.

Further, the examiner asserts that the motivation for the combination is a "more accurate detection". However, Murata fails to connect the cavity with more accurate detection; instead, it is Applicants who do so.

As set forth in the present specification, the cavity is disposed at the detection device detecting a consumption status of liquid contained in the liquid container for communicating with an interior of the liquid container and defining a vibration part. It is configured that the liquid contained in the liquid container contacts the vibrating part via the cavity. In this configuration, the detection device pinpoints its detection of the liquid consumption on a surface of the liquid contained in the liquid container, so that it can detect the consumption status of the liquid contained therein.

Defining the vibration part with the cavity not only makes the detection device capable of pinpointing the detection, but also allows the piezo element to be designed in a smaller size and, consequently, lowers the production cost of the detection device (because the piezo element is typically expensive), and also reduces an operation voltage of the piezo element. For example, in an ink cartridge used in an ink jet printer, reduction of the operation voltage becomes advantageous particularly when available voltage is limited.

Further, according to the claimed invention, as to the detection device, combining the feature of "in a detection device for detecting a consumption status of liquid contained in a liquid container ..., the detection device comprising an actually vibrating part facing a cavity which defines the vibration of the liquid" with that of "a measurement circuit segment for measuring a residual vibration of the detection device", allows more precise detection of the residual vibration (free vibration) which may be a small amount, that may be interfered with by noise. At the time of the detection of the residual vibration, the noise takes place due to an unnecessary vibration (a different mode of vibration from the expected mode in the design) originating from errors in size and/or during assembly of a piezo electric element at the time of manufacture. However, in accordance with the claimed invention, the vibration part of the detection device is

defined with the cavity, so that such unnecessary vibration can be suppressed and also there can be preformed a more precise detection of a smaller amount of the counter-electromotive voltage caused in connection with the residual vibration.

Moreover, as explained above, it is configured that the ink contained in the liquid container contacts the vibrating part via the cavity. In this configuration, the detection device detects "digitally" whether a surface of the liquid contained in the liquid container exists at a particular position (i.e. on the cavity). As a result, even if the residual vibration is smaller, more precise detection can be performed.

(ii) Second, for the sake of argument alone, even assuming that one of ordinary skill in the art were motivated to combine Pfeiffer and Murata as suggested by the Examiner, any such combination would still fail to teach or suggest all of the elements as set forth and arranged in the claims.

Claim 20 sets forth a detection control circuit for detecting a consumption status of liquid contained in a liquid container by a detection device, comprising a measurement circuit segment for measuring a residual vibration of the detection device.

By way of non-limiting example, the "residual vibration" is that of the actually vibrating part after an active excitation input is turned off. Stated another way, the actually vibrating part is vibrated via an excitation input to generate a wave that enters the container. The excitation input is then turned off, and the actually vibrating part is again vibrated as the wave comes back from the container to the actually vibrating part. The resultant vibration of the actually vibrating part—as from the wave returning from the container—is detected as the "residual vibration". See, for example, the paragraph bridging pages 35 and 36 in the present specification.

In contrast to that set forth in claim 20, both Pfeiffer and Murata measure the "resonant frequency" of vibration of the vibration generator as an excitation input voltage is applied thereto.

Pfeiffer teaches measurement of the "resonant frequency" of the vibration. See, for example, Pfeiffer at: col. 2, lines 17-35 ("natural resonant frequency"); col. 4, lines 51-64 (excitation applied to excitation transducer 30 to set diaphragm into "flexural oscillations", which are then exerted on and measured by the receiving transducer 40); and col. 5, lines 11-15.

Similarly to Pfeiffer, and in contrast to that set forth in independent claim 20, Murata teaches that "oscillation is picked up by an piezo-electric element 14b for receiving" when "AC voltage is impressed to an oscillating piezo-electric element 14a ..." See Murata's English abstract at lines 16-21. That is, Murata measures the change in resonant vibration of the piezo-electric 14b and diaphragm 12 as the AC voltage is input to the piezo-electric element 14a.

Accordingly, even assuming that one of ordinary skill in the art were motivated to combine Pfeiffer and Murata as suggested by the Examiner, any such combination would still not teach or suggest the "residual vibration" as set forth in the claims.

For at least any of the above reasons, Pfeiffer and Murata fail to render obvious Applicants' claims 20-22.

- The Examiner rejected claims 45 and 46 under §103(a) as being unpatentable over Pfeiffer in view of Murata and US Patent 5,689,288 to Wimmer (hereinafter Wimmer). Applicants respectfully traverse this rejection because the references fail to establish *prima facie* obviousness.

As noted above, the Examiner's attempted combination of Pfeiffer and Murata is deficient. Wimmer fails to cure the above-noted deficiencies. Accordingly, Pfeiffer, Murata and Wimmer fail to render obvious the dependent claims 45 and 46.

Further, one of ordinary skill in the art would not have been motivated to modify Pfeiffer with the teachings of Wimmer because such would impermissible change the principle of operation in Pfeiffer. Yet, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious.[4]

In the present case, Pfeiffer has a non-invasive principle of operation. That is, Pfeiffer performs measurement without altering the construction of the container itself. Again, Pfeiffer specifically teaches that there should be **no** cavity in the container wall. See: col. 1, lines 52-59

[4] *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). See also MPEP § 2143.01.

("does not require any opening in the container wall") ; col. 1, lines 21-41 (discussing problems with openings [cavities] in the container wall); and col. 3, lines 21-24, 38-40.

In contrast to Pfeiffer's non-invasive principle of operation, Wimmer operates according to an invasive principle. Specifically, Wimmer teaches that the vibratory bar 14 for measuring is placed within the ink reservoir.

Accordingly, one of ordinary skill in the art would not have been motivated to modify Pfeiffer with the teachings of Wimmer, as suggested by the Examiner, because doing so would impermissibly change Pfeiffer's principle of operation.

Allowable Subject Matter

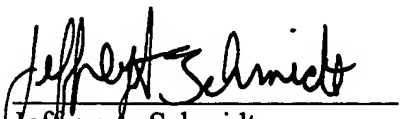
Applicants thank the Examiner for indicating that claims 23 and 28-34 are allowed, and that claims 24-27 would be allowable if rewritten in independent form. However, because of the belief that independent claim 20 is allowable as written, Applicants have not rewritten claims 24-27 in independent form at this time.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



Jeffrey A. Schmidt
Registration No. 41,574

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

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